Issues from the Gaia DR2 validation

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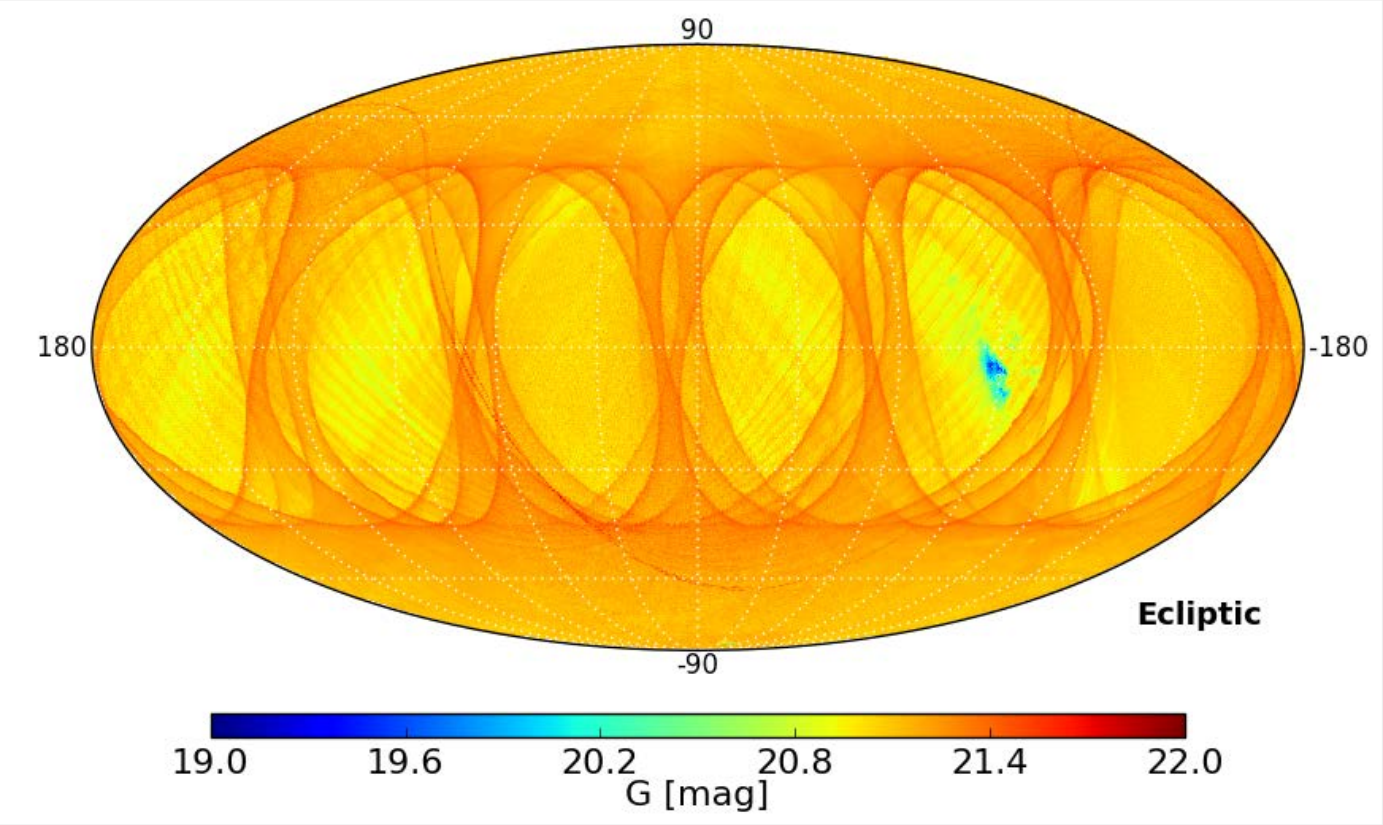
Gaia DR2 validation

- Just ***how good*** is the catalogue ?
- Any obvious artefacts ?
- Gaia DR2 is a ***preliminary*** release
  - Several pipelines are still not activated
  - The sky consists of isolated point sources
  - 22 months of data
- Validation must dig into the caveats
  - and check the fine print

Validation of Gaia DR2: papers

- Gaia papers
  - **Gaia DR2**: Brown & al, A&A special issue
  - **Validation**: Arenou & al, arxiv.org/pdf/1804.09375
  - **Astrometry**: Lindegren & al, A&A special issue
  - **Photometry**: Evans & al, A&A special issue
  - **Radial velocities**: Sartoretti et al, A&A special issue
  - **Variability**: Holl & al, arxiv.org/pdf/1804.09373
  - **Minor planets**: Spoto et al, A&A special issue
  - **Astrophysical parameters**: Andrae et al, A&A special issue
- Gaia DR2 online documentation
  - **Data model**
  - Ch. 10: **Validation** (Antoja et al.)

G: limiting magnitude (99%)

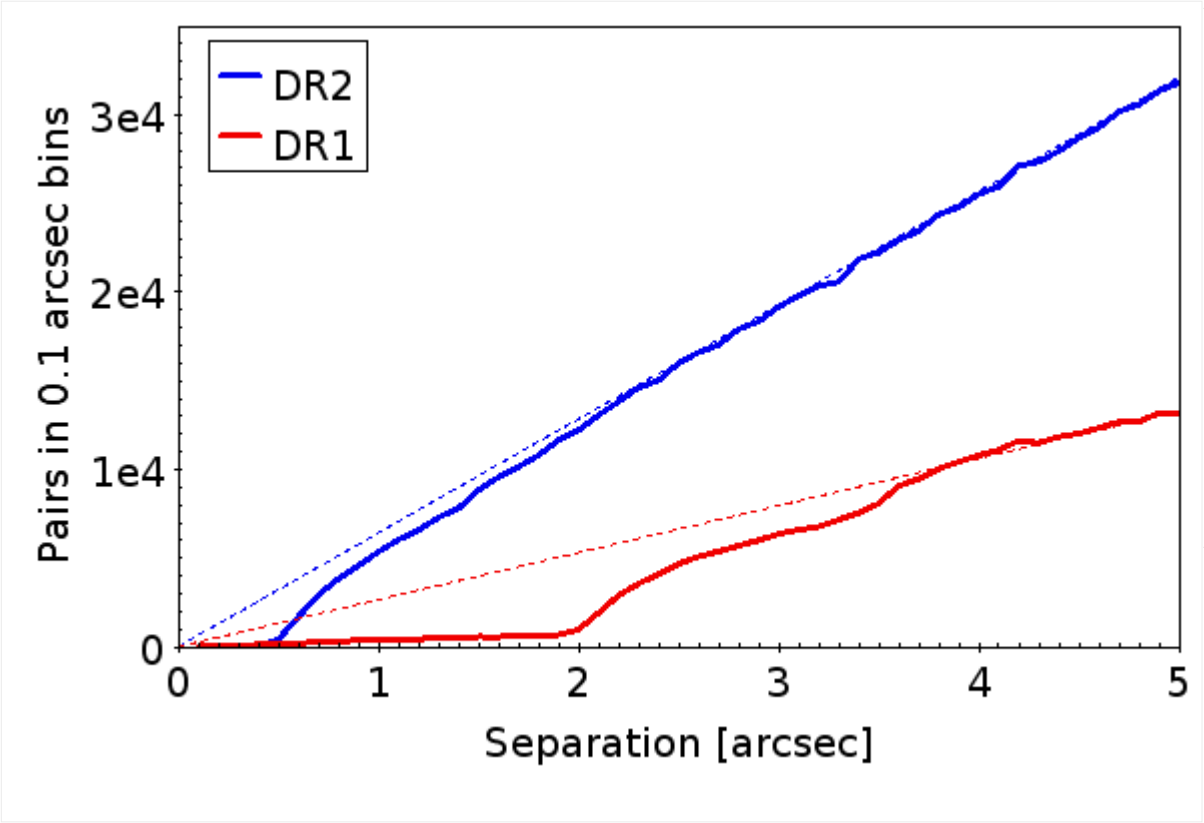


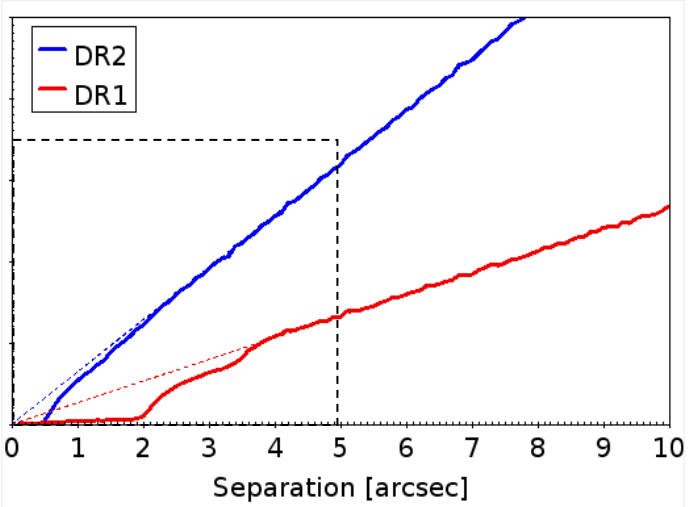
Limit well beyond 20 mag, except in very dense areas.

Sky coverage depends on the scanning law.

Angular Resolution

Angular resolution in a dense field

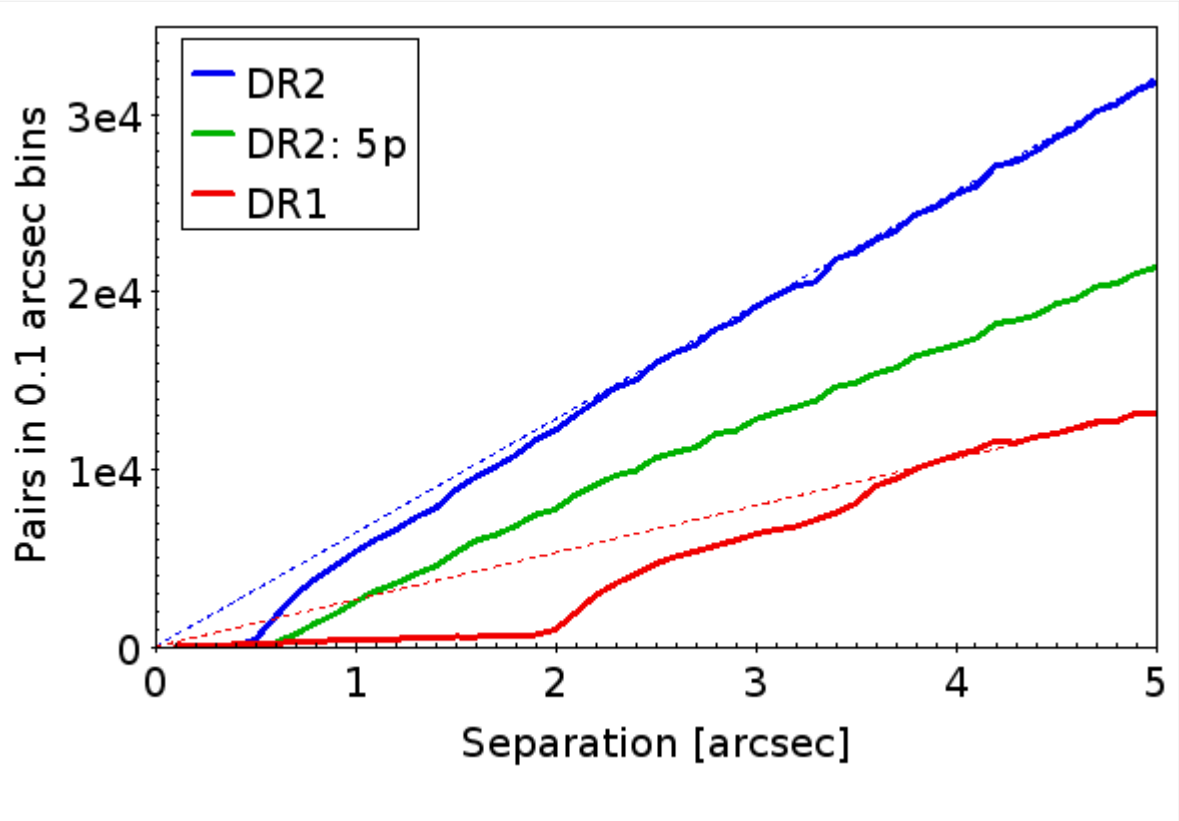




56% more sources in DR2
Much better resolution

Slope of dotted lines: $\pi \rho N \Delta r$

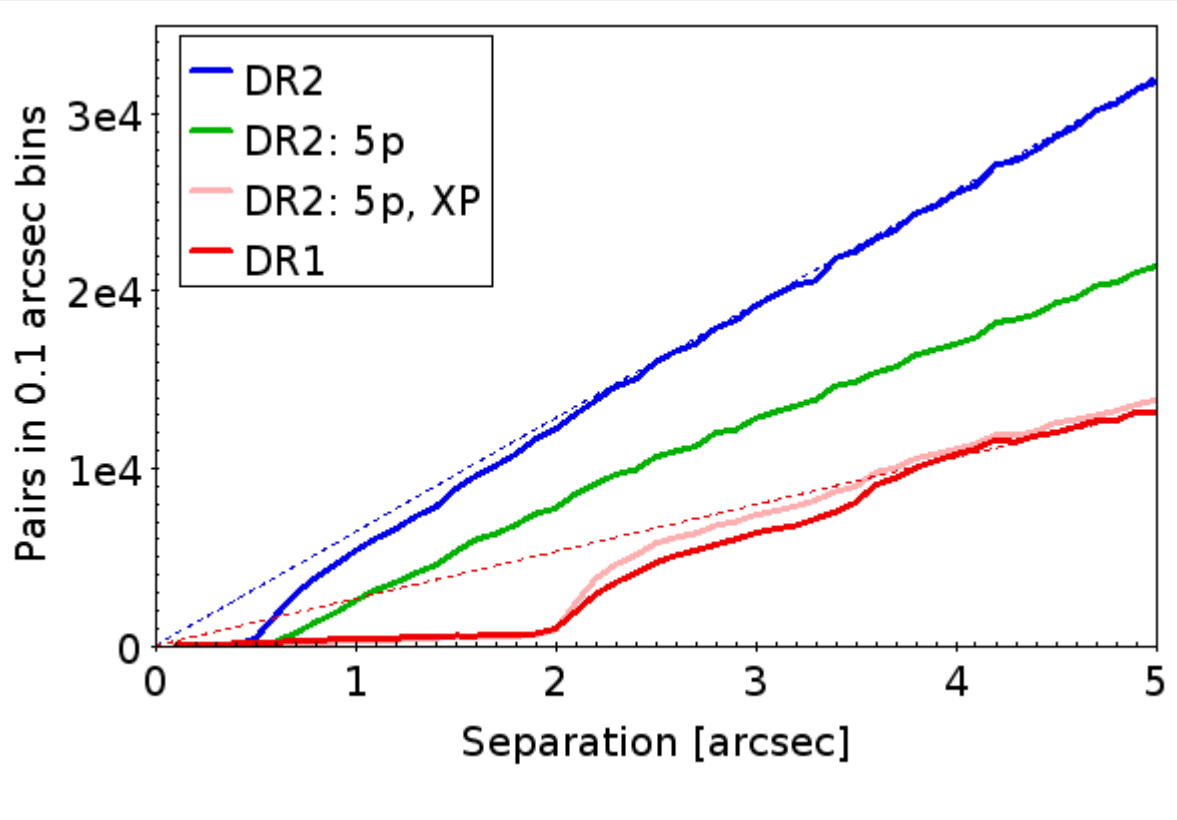
Angular resolution in a dense field



5p: Full astrometry

5p: still good resolution but less than for 2p+5p.

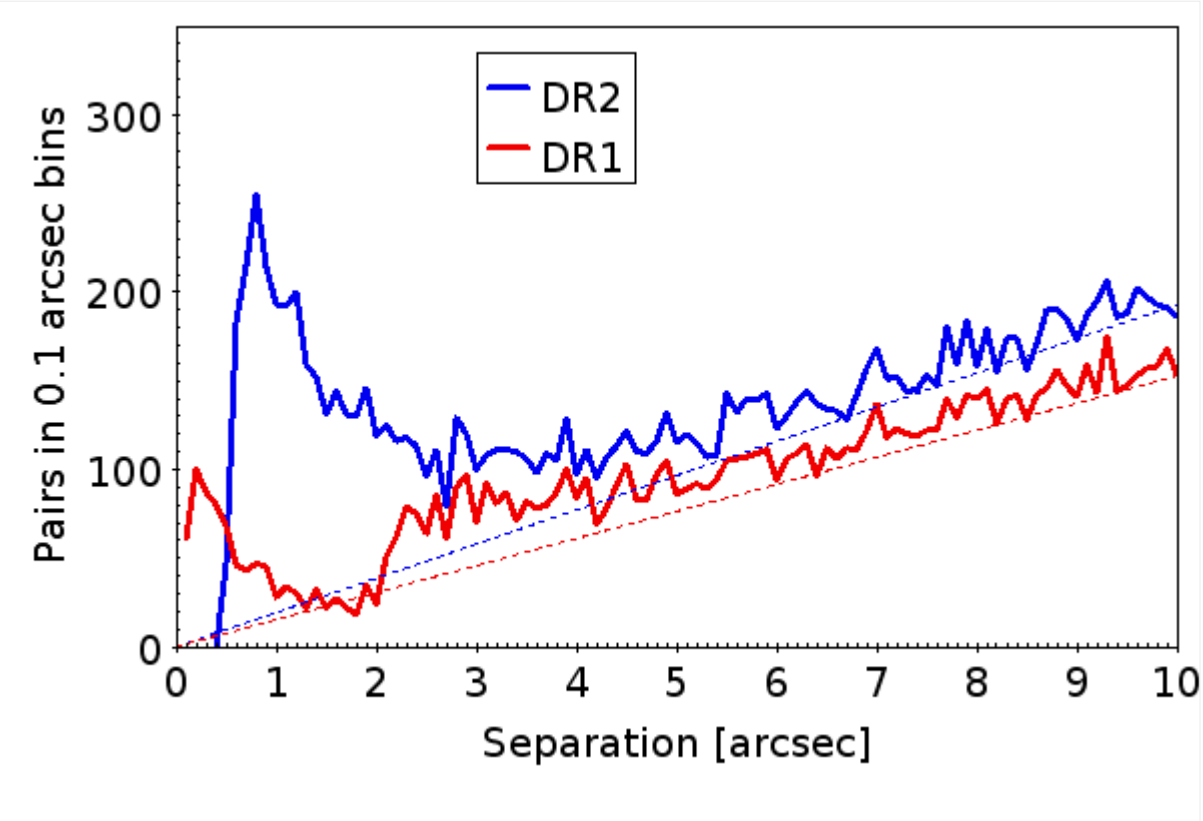
Angular resolution in a dense field



5p + XP:
DR1 like resolution.

The gain is sources from DR1 to DR2 is mainly due to waiving the requirement of having colours for all sources.

Angular resolution in a sparse field

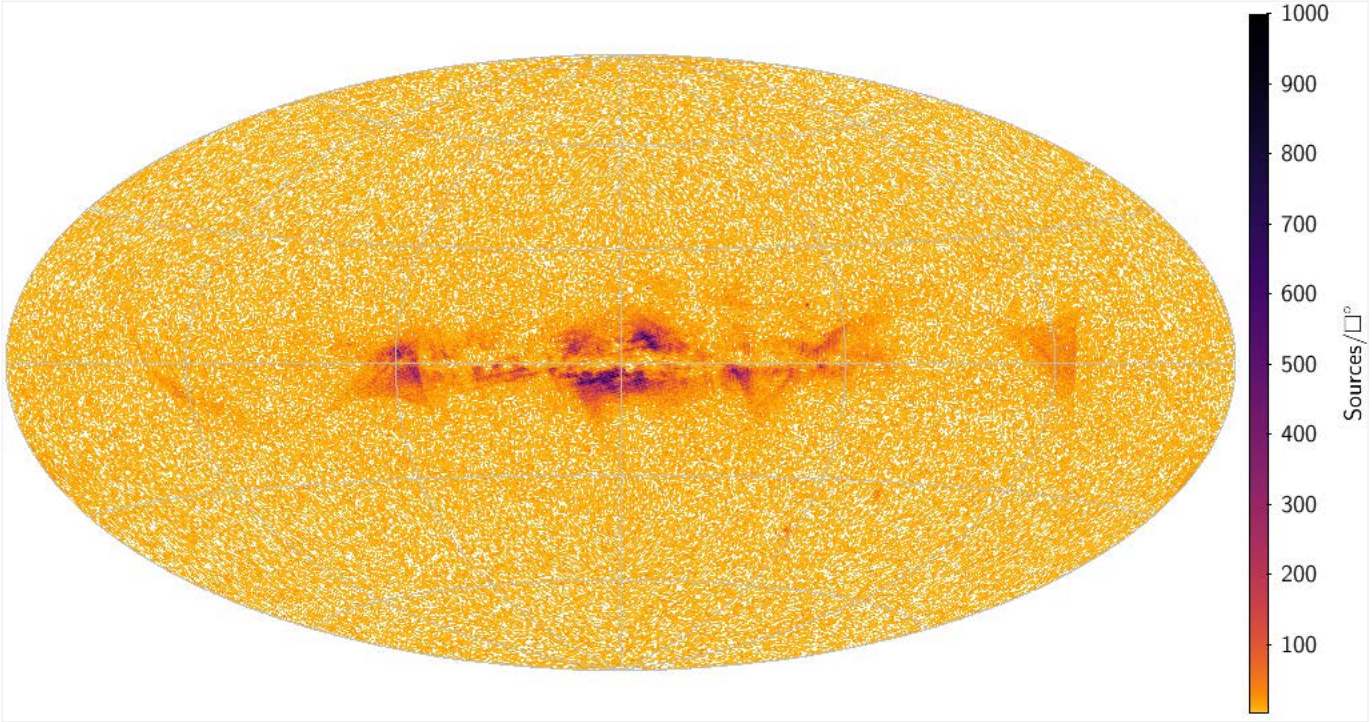


12% more sources
Better resolution

Peak of binaries

Astrometry

Gaia DR2: nearby stars

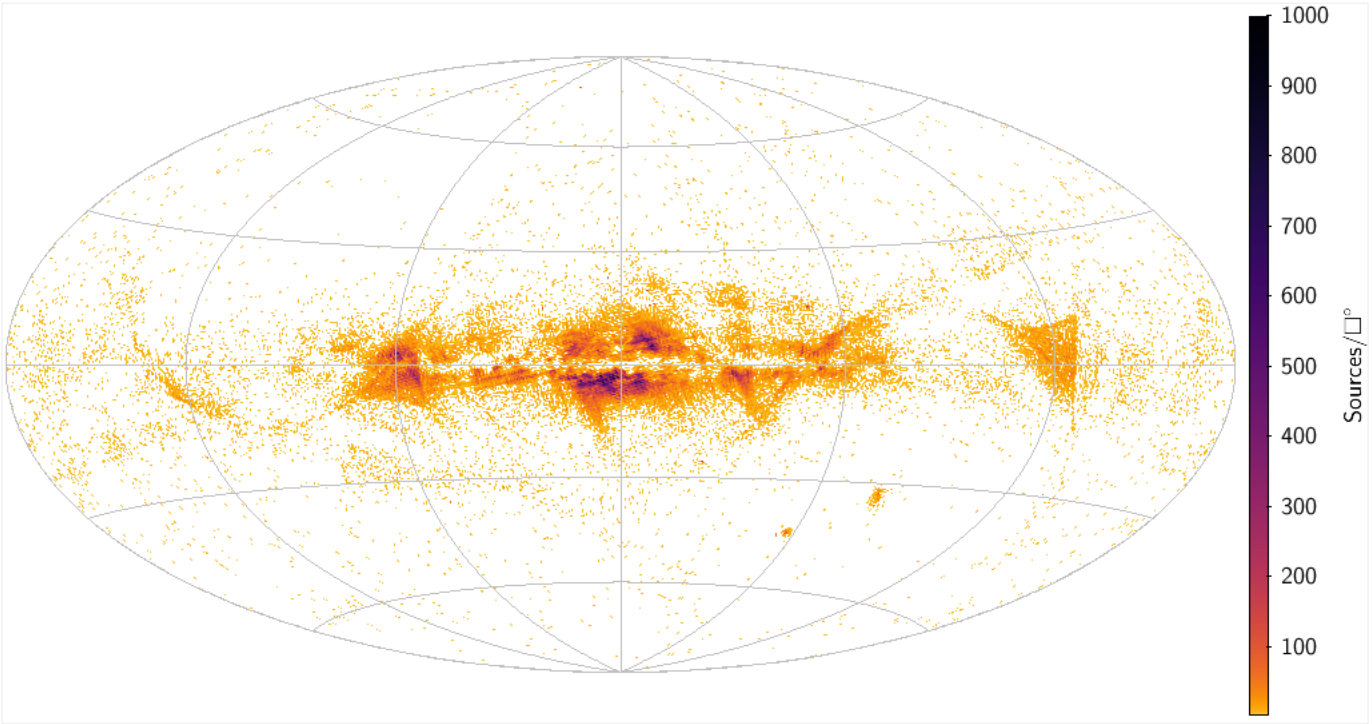


$\varpi > 10$ mas

$\varpi/\sigma_\varpi > 10$

439020 sources

Through the looking glass

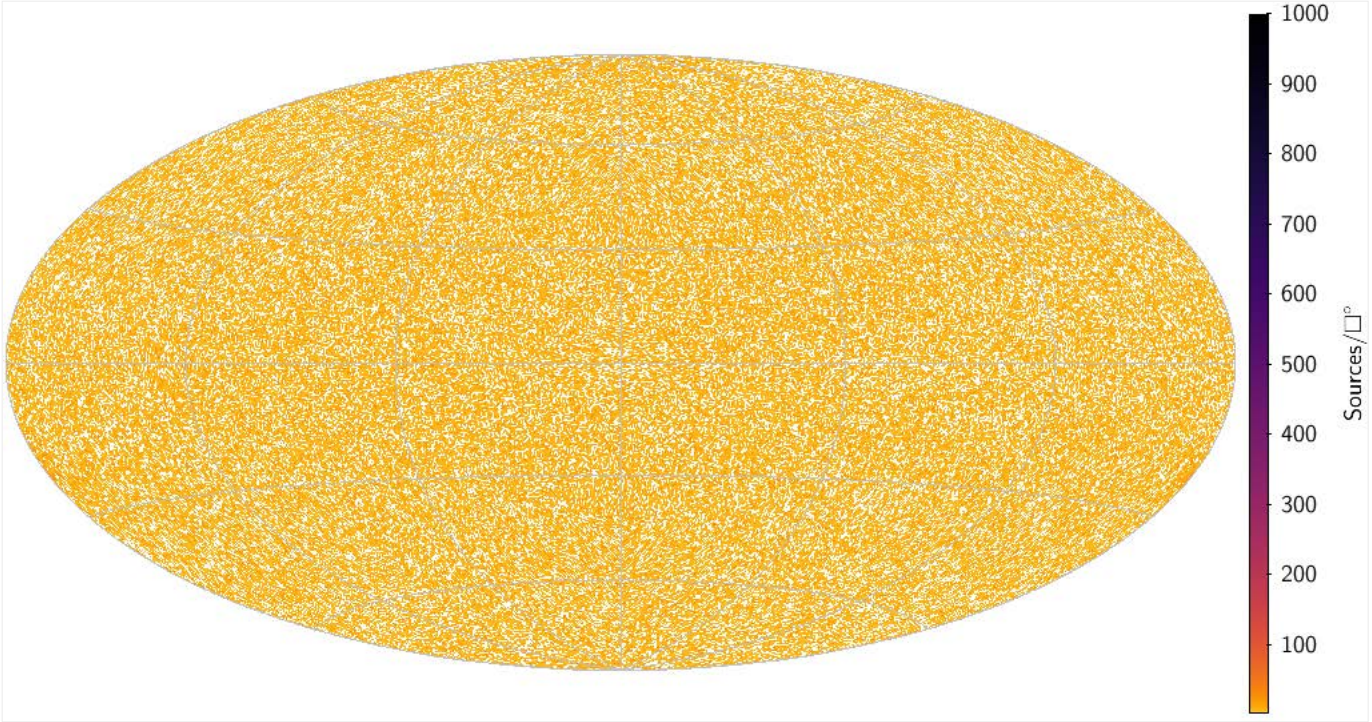


$\varpi < -10$ mas

$\varpi/\sigma_{\varpi} < -10$

113393 sources

Gaia DR2: nearby stars, filtered



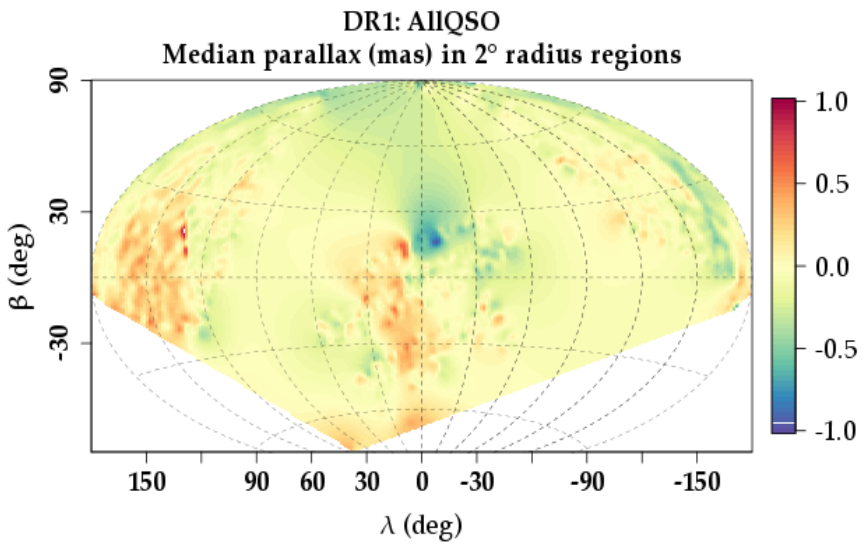
$\varpi > 10$ mas
$\varpi/\sigma_\varpi > 10$

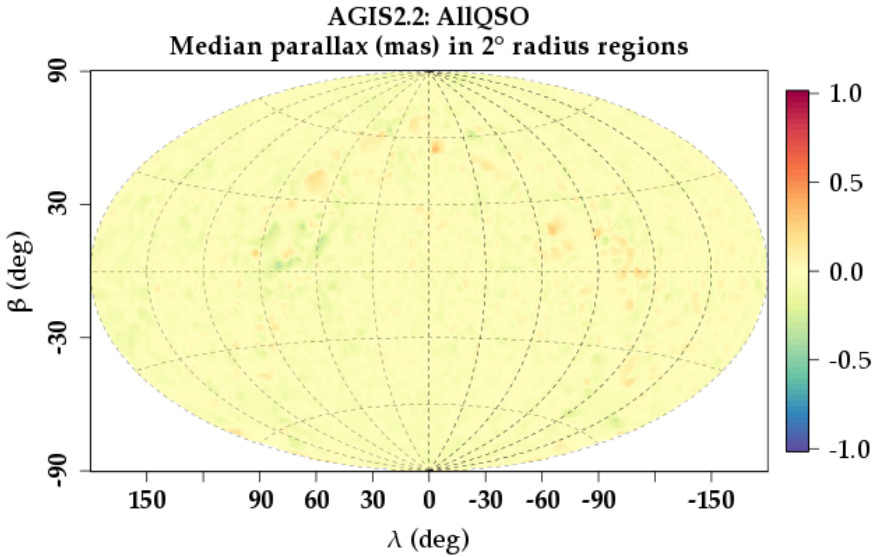
+ filters: astrometric & photometric (Lindegren et. al.)

254007 srcs (58%)

Negative ϖ: 298
i.e. 0.1% spurious

QSO parallax in 2º regions: DR1 & DR2

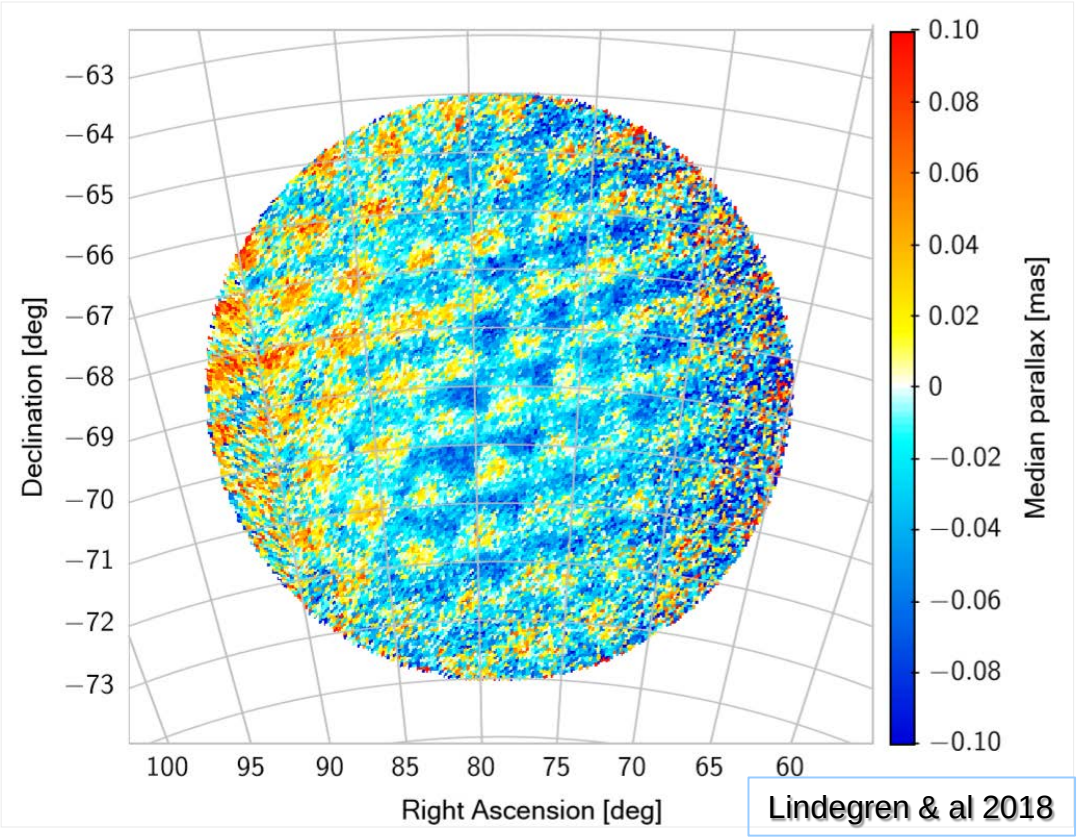




Median -0.029 mas

Arenou & al 2018

LMC median parallaxes



Lindegren & al 2018

Astrometric parameters show systematics at a ~ 1º scale.

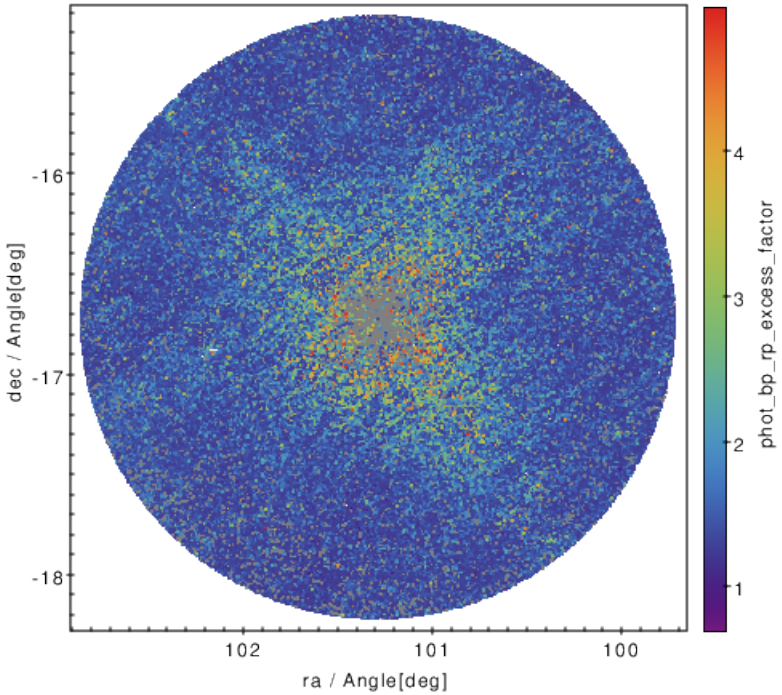
Level 50-70 μas.

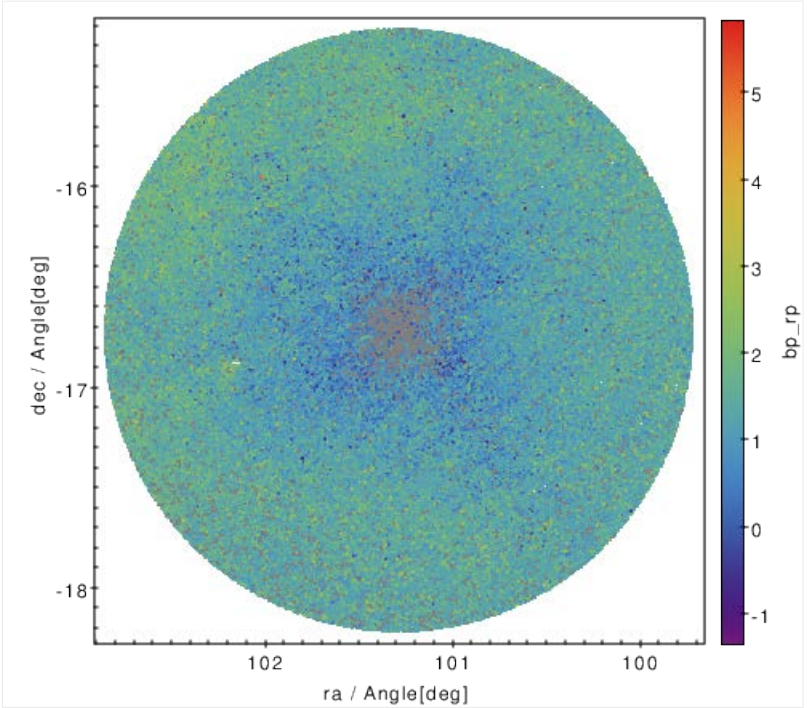
Photometry

Gaia DR2 photometry

- G magnitudes for all sources, 1693 million
  - PSF/LSF fitting to narrow image
- BP-RP colours for 1379 million sources
  - Diaphragm photometry in 3.5 by 2.1 arcsec windows
    - No de-blending (yet!)
    - Contamination often inevitable
      - Fainter components
      - Crowded fields
  - Flux excess factor (BP+RP)/G often too large
    - **Especially for faint sources**
    - **Especially in crowded fields**

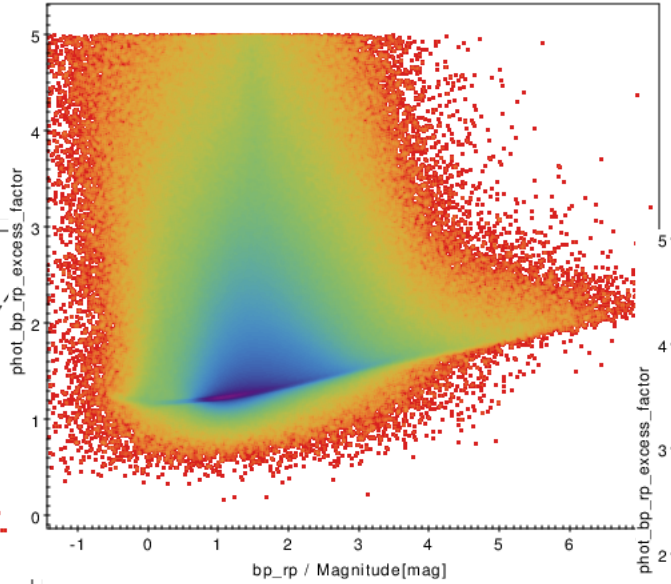
Flux excess & colour around Sirius



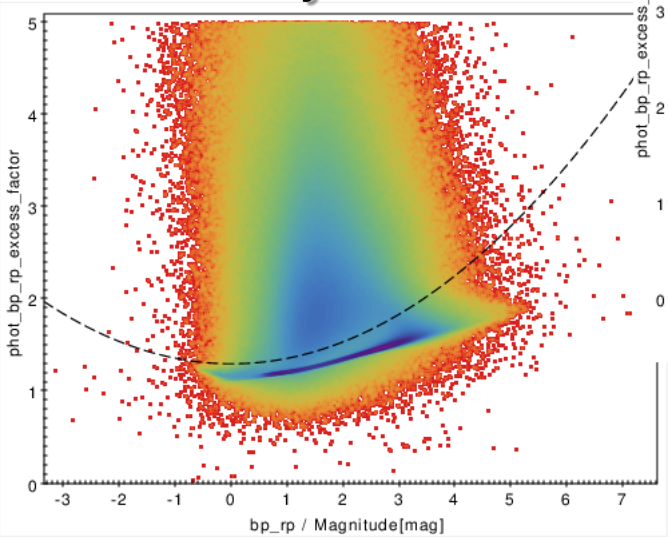


Flux ratio (BP+RP)/G versus colour

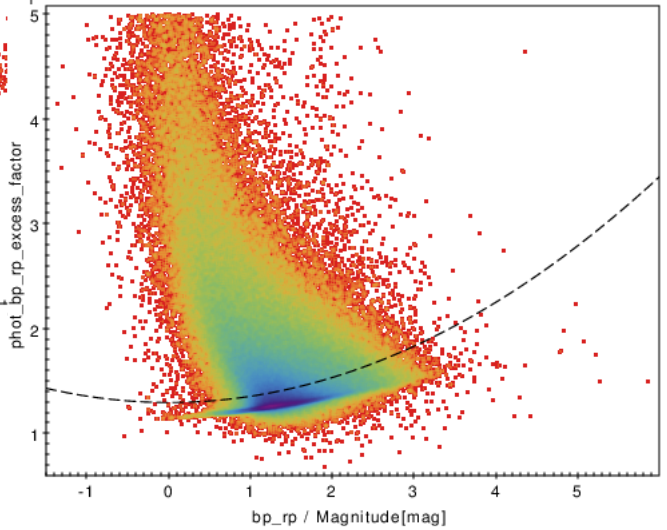
Random



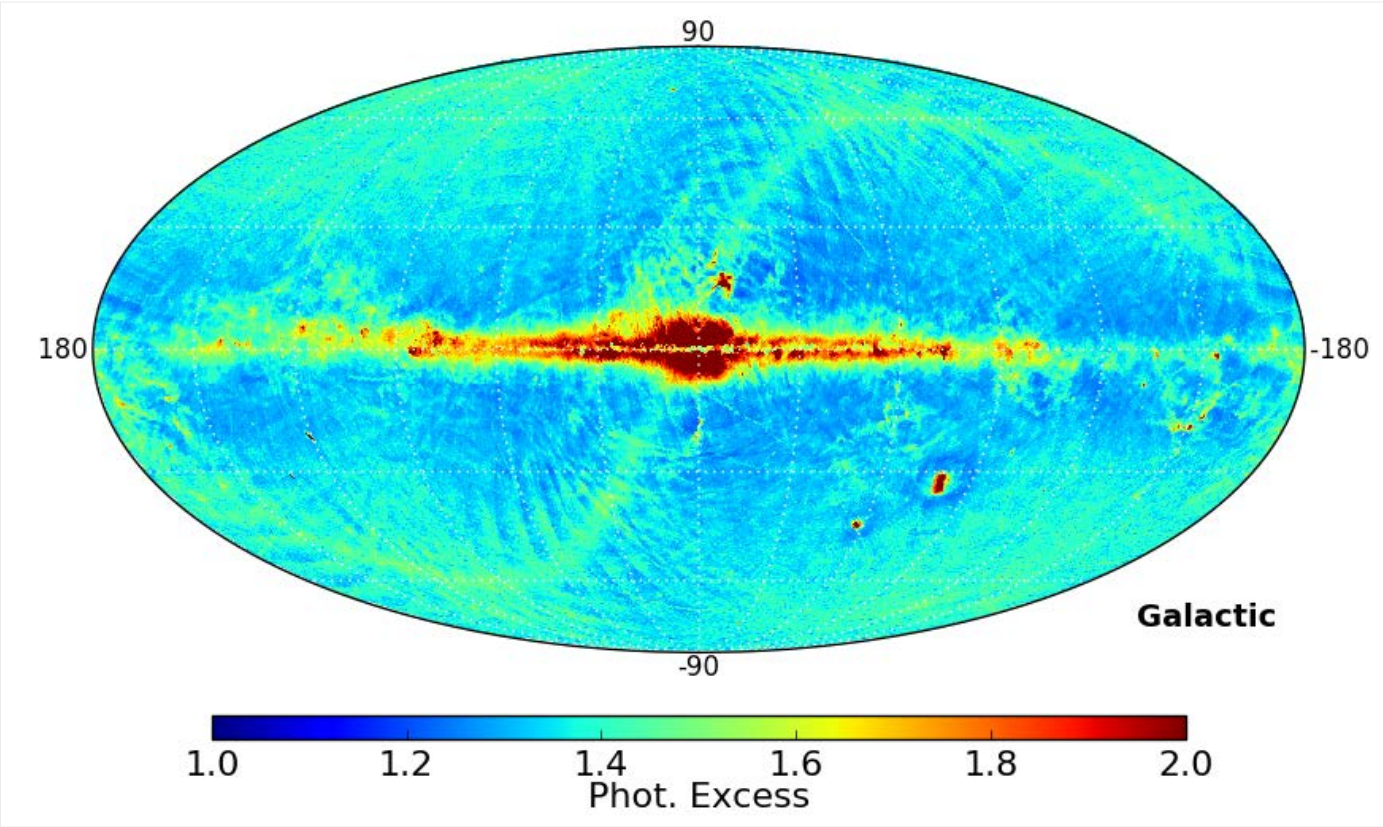
Nearby sources



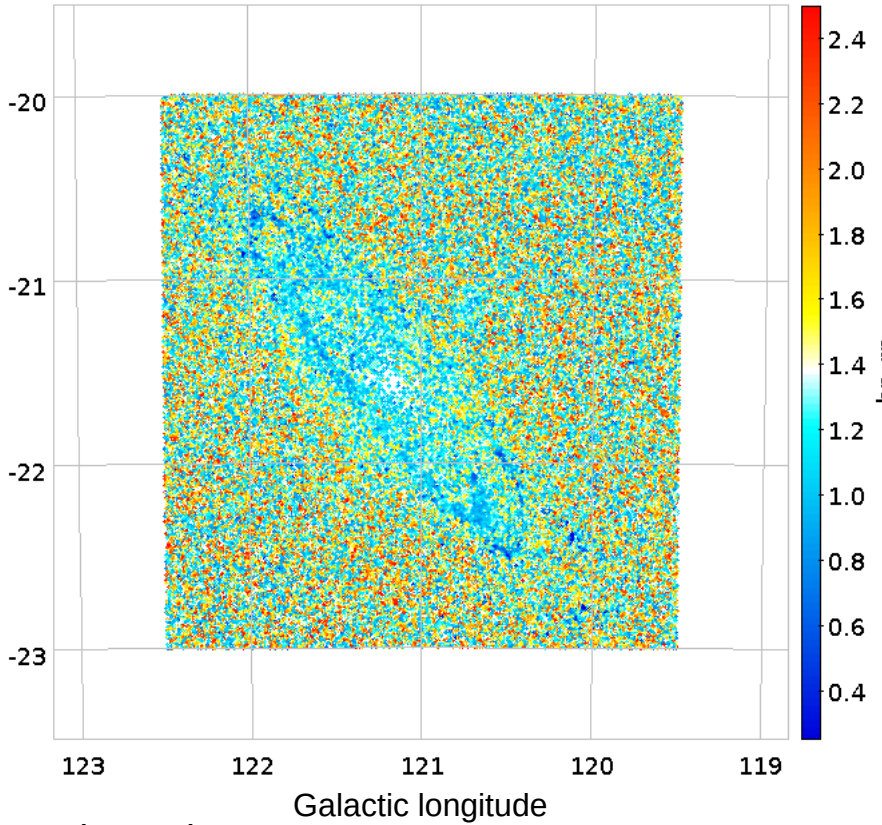
Sirius field

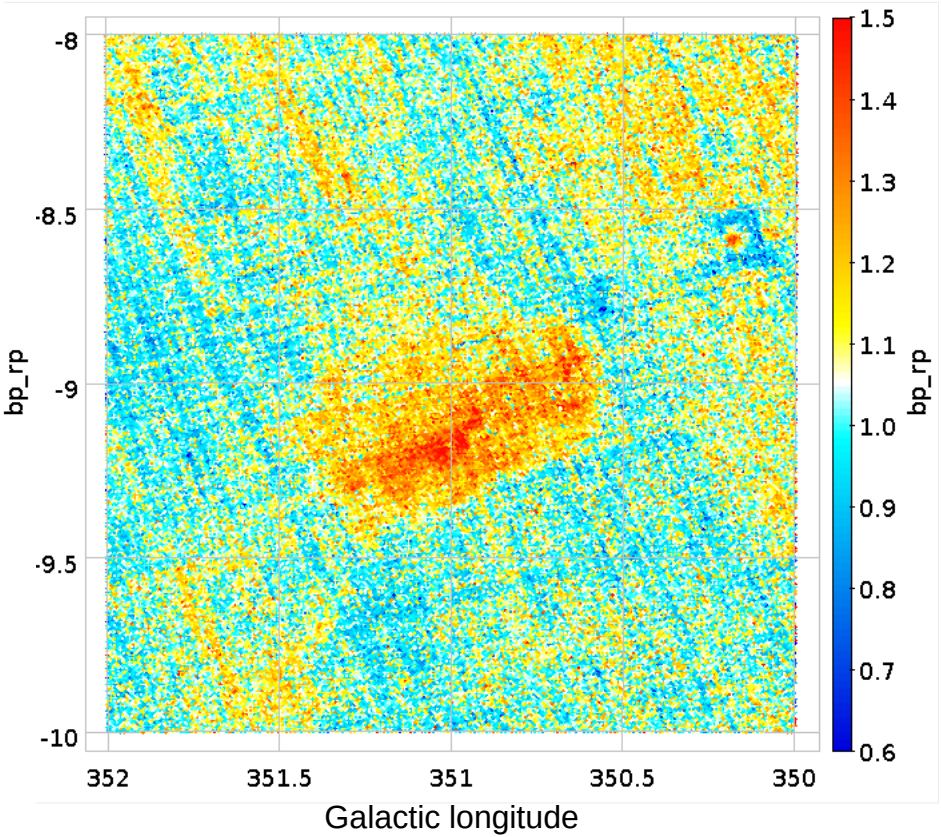


Flux excess: zodiacal light + criss cross

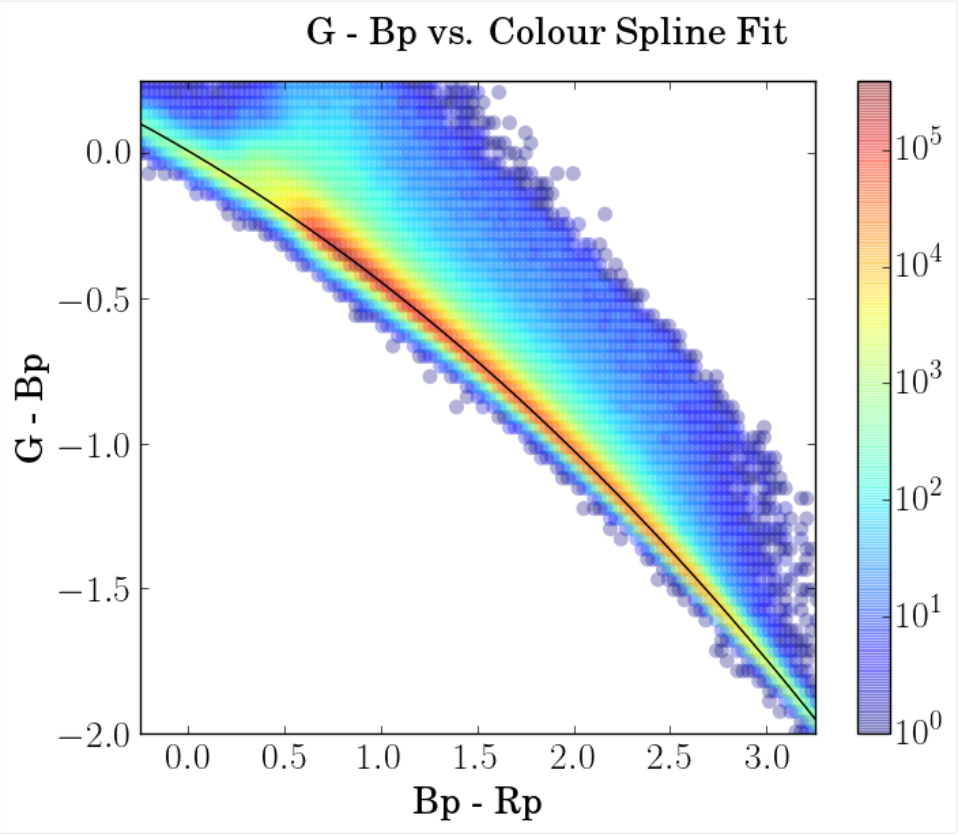


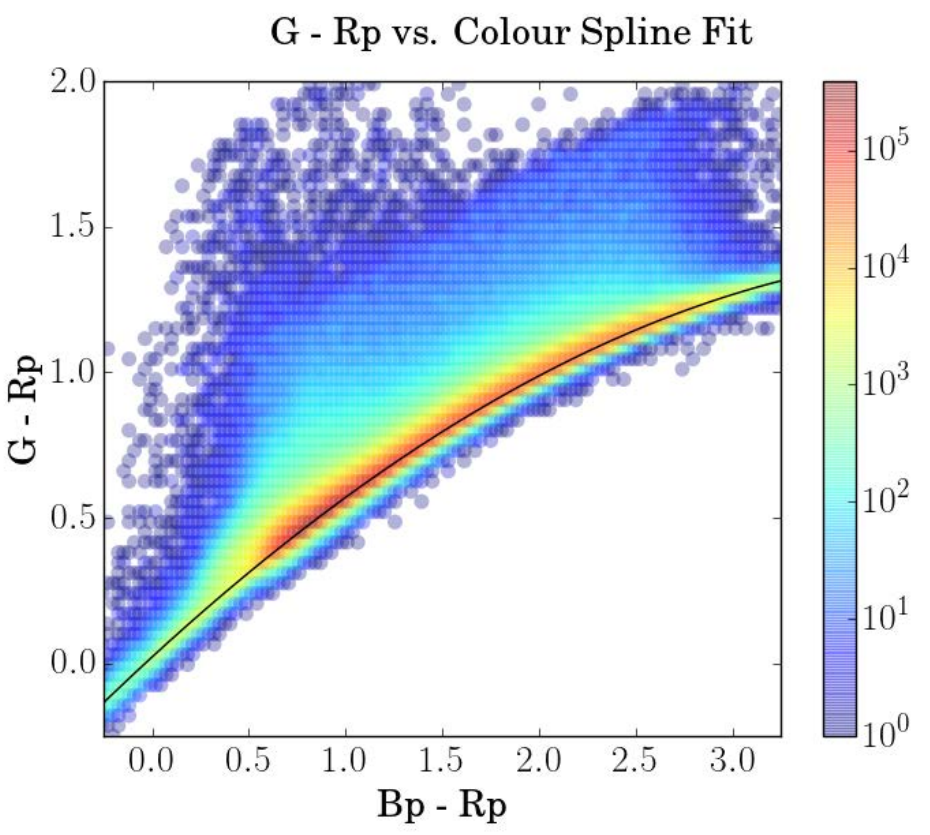
M31 and a random dense field



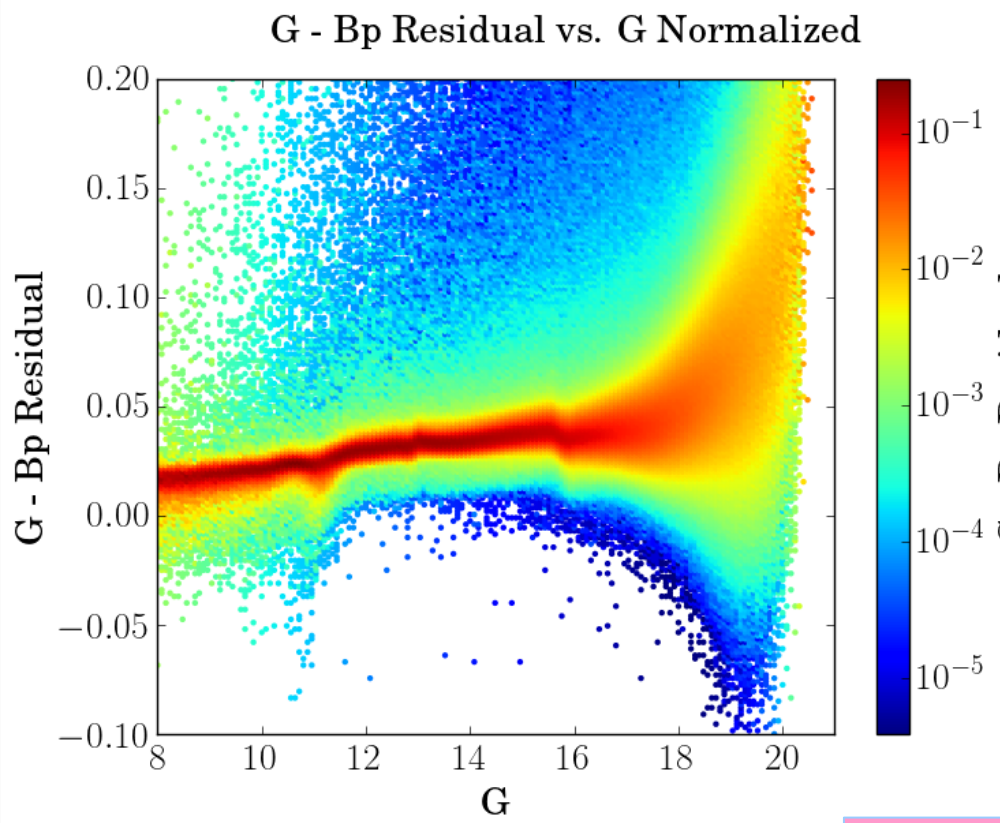


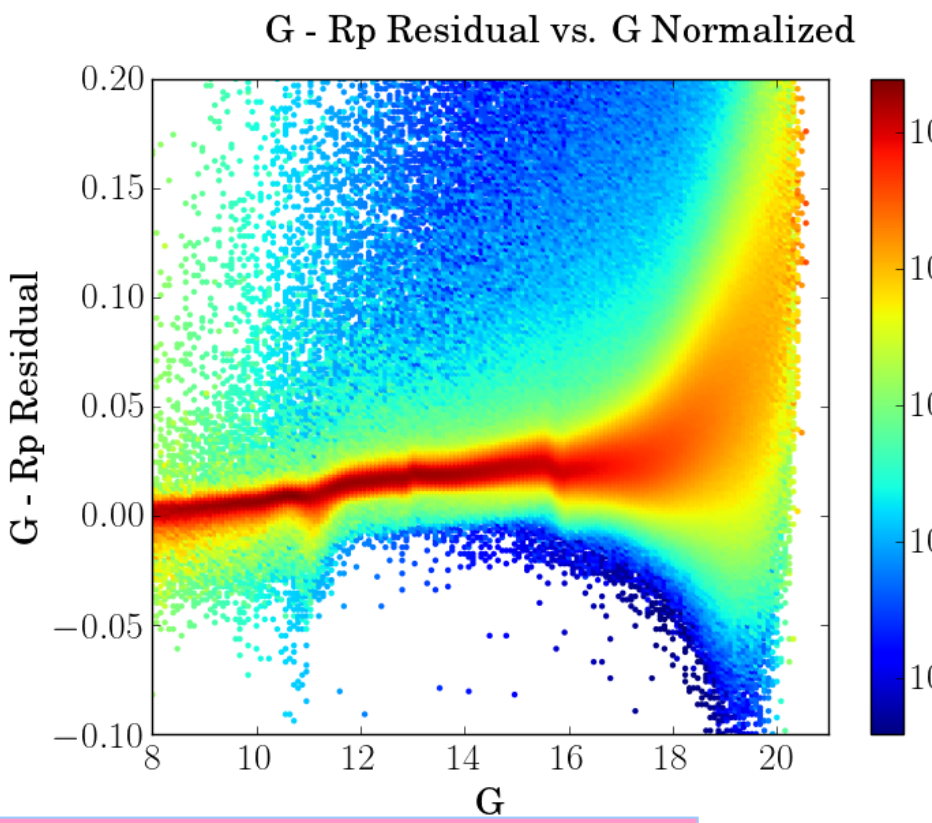
Fit to G-XP vs colour (HQ, high *b* sample)





Residuals to G-XP fit

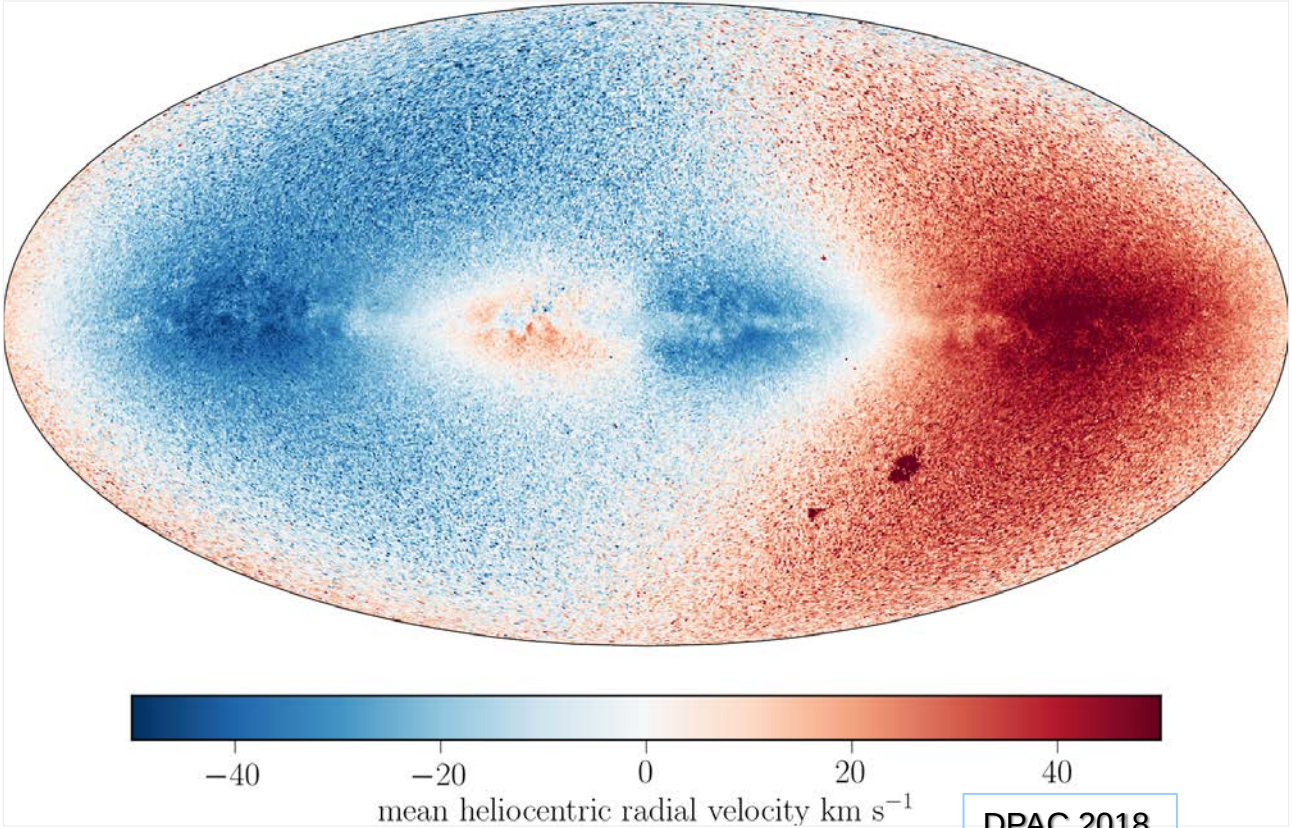




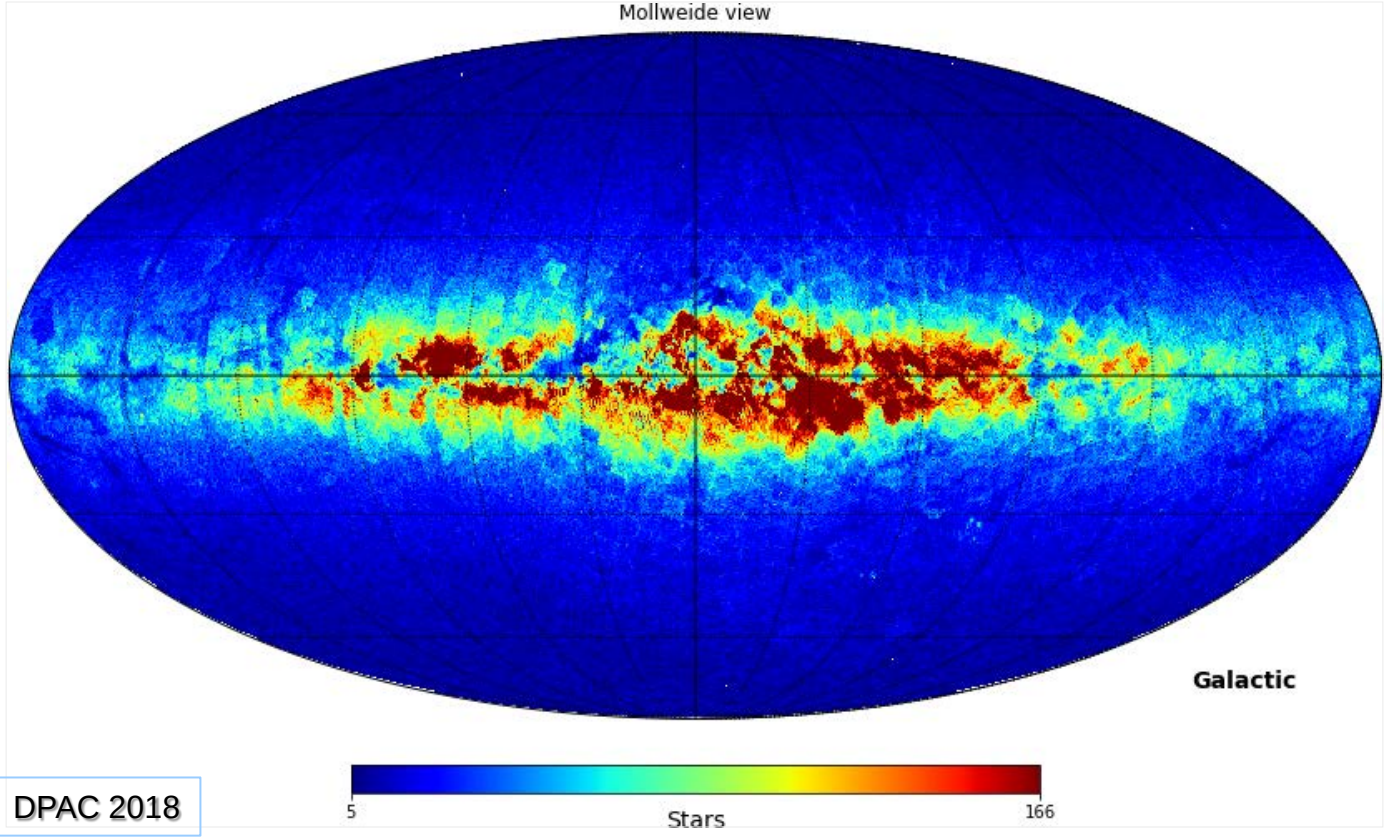
Trend (~ 3 mmag/mag), bumps, faint-end bias.

Radial velocities

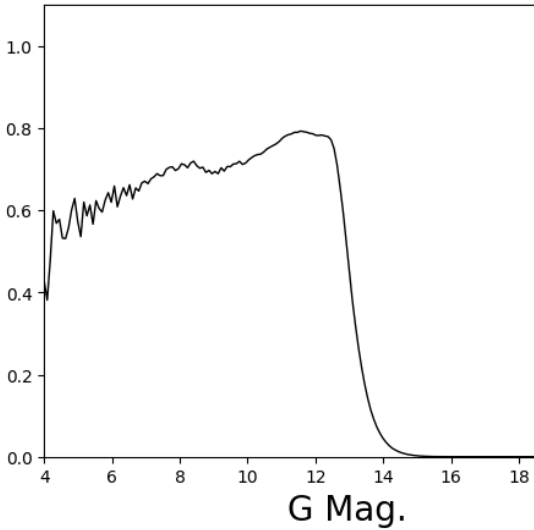
Mean radial velocities



Radial velocities



Magnitude limit, depending on input list.

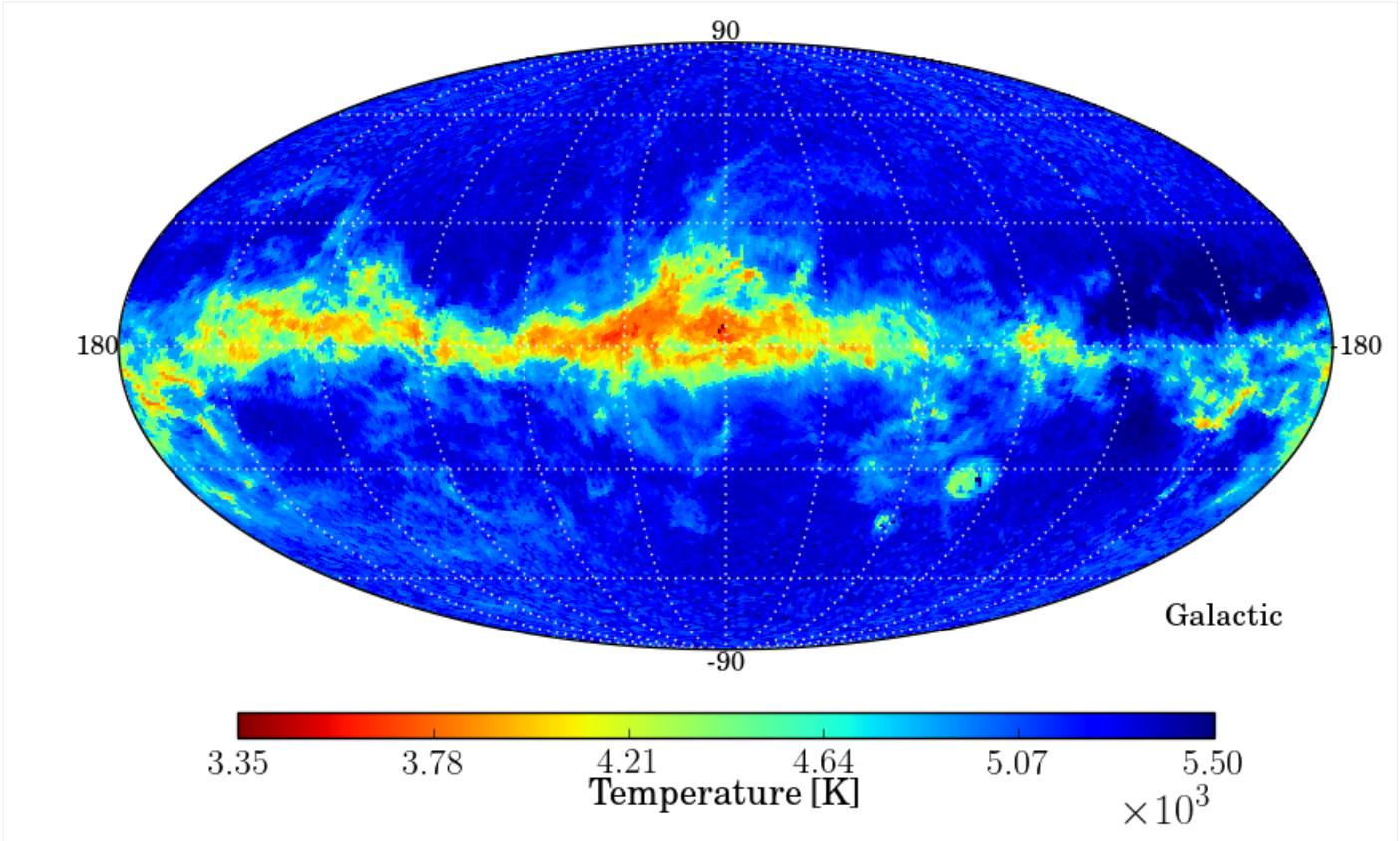


Astrophysical parameters

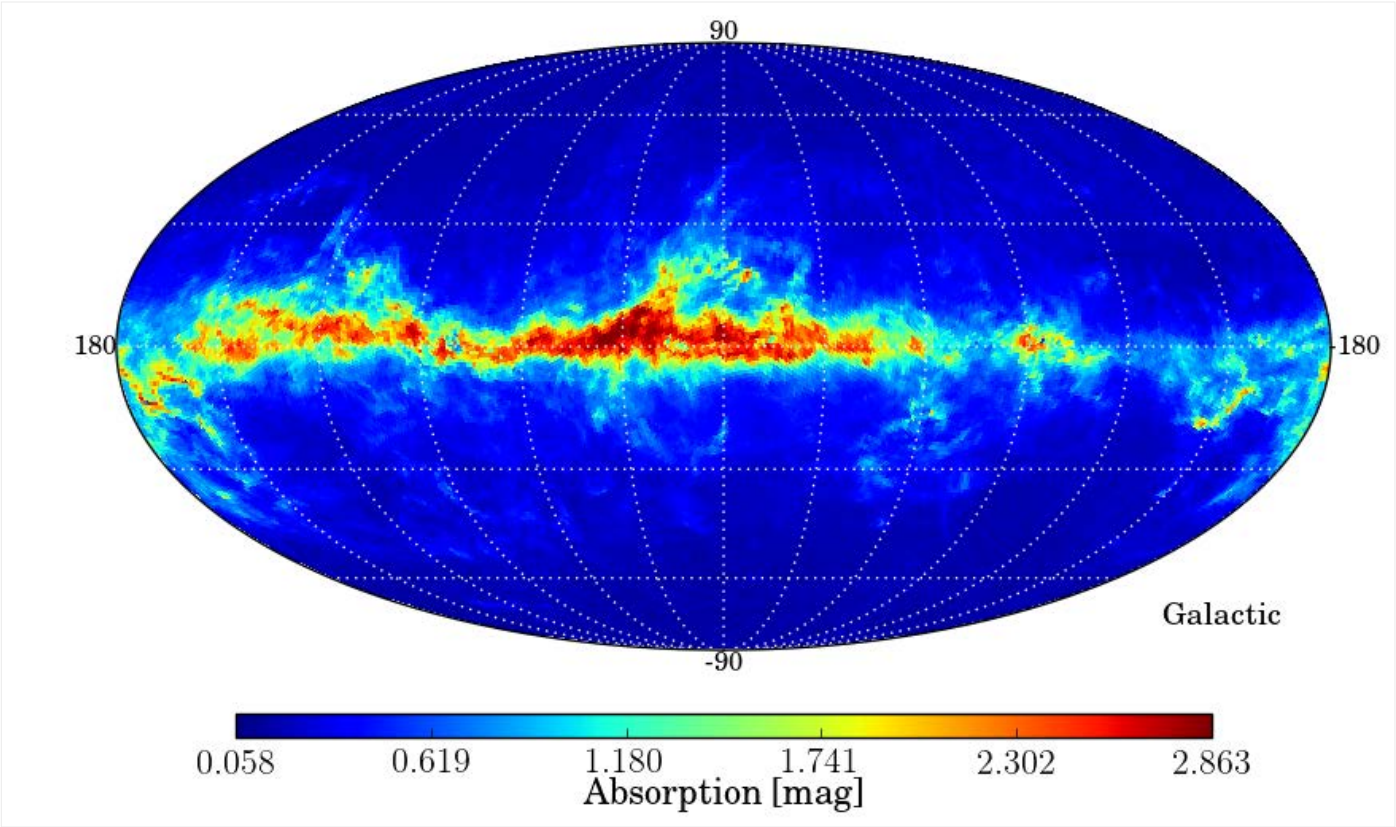
Astrophysical parameters

- T_{eff}, A_{G}, $E_{\mathrm{BP\text{-}RP}}$, L, R
- Only for sources brighter than 17 mag
- Based on integrated G, BP, RP fluxes and parallaxes
  - No spectra (yet)
- Degeneracies between T_{eff} and A_{G} are unavoidable

Effective temperature

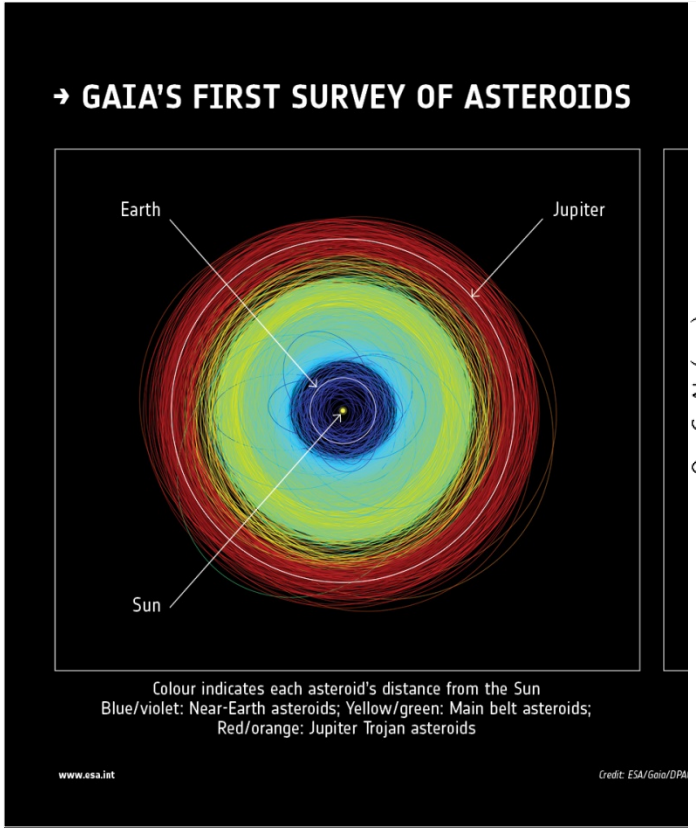


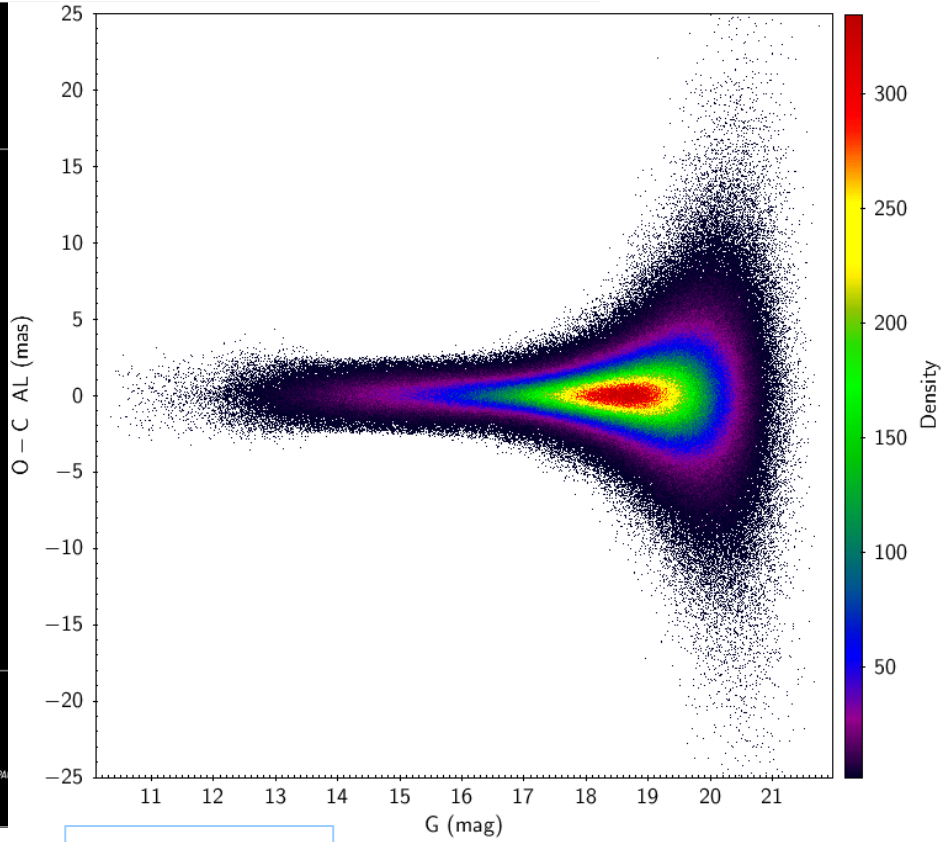
Absorption in the G band



Solar system

14000 known minor planets





Spoto & al 2018

Gaia DR2

- Gaia DR2 is a ***preliminary*** release
  - Imperfections are expected and are indeed present!

Lennart Lindegren, August 2017:

Gaia DR2 will not be perfect, but it will be fantastic!


y ahora a trabajar …